

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of

Seiji IWAI et al.

Serial No. : 10/536,594

Group Art Unit: 3656

Filed: May 26, 2005

Examiner: Mr. James Pilkington

For: ORIGIN ADJUSTING DEVICE OF INDUSTRIAL ROBOT

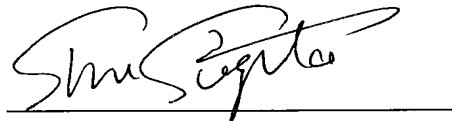
Commissioner for Patents

Alexandria, VA 22313-1450

STATEMENT UNDER 37 C.F.R. 1.55(a)

Sir,

I, Shu SUGITA, hereby declare that I am conversant with both English and Japanese languages, and certify to best of my knowledge and belief that the attached are true and correct English translation of Japanese Patent Application No. 2003-345406 filed on October 3, 2003.

A handwritten signature in cursive script, appearing to read "Shu Sugita", written over a horizontal line.

Shu SUGITA

Date: September 1, 2009

JAPAN PATENT OFFICE

This is to certify that the annexed is a true copy of the following application as filed with this office.

Date of Application: October 3, 2003

Application Number: Japanese Patent Application
No. 2003-345406

Applicant(s): Matsushita Electric Industrial Co., Ltd.

Commissioner,
Japan Patent Office:

(Seal)

Issuance No.

	[Designation of Document]	Patent Application
	[Reference Number]	2621550006
	[Submission Date]	October 3, 2003
	[Addressed To]	Commissioner, Patent Office
5	[International Classification]	B25J 9/10
	[Inventor]	
	[Address]	c/o Matsushita Welding Systems Co., Ltd, 3-1-1, Inazu-Cho, Toyonaka-city, Osaka 561-0854 Japan
10	[Name]	Seiji IWAI
	[Inventor]	
	[Address]	c/o Matsushita Industrial Information Equipment Co., Ltd, 3-1-1, Inazu-Cho, Toyonaka-city, Osaka 561-0854 Japan
15	[Name]	Yukinori HIGASHINO
	[Applicant for Patent]	
	[Identification Number]	000005821
	[Appellation]	Matsushita Electric Industrial Co., Ltd.
	[Agent]	
20	[Identification Number]	100097445
	[Patent Attorney]	
	[Name]	Fumio IWAHASHI
	[Designated Agent]	
	[Identification Number]	100103355
25	[Patent Attorney]	
	[Name]	Tomoyasu SAKAGUCHI
	[Designated Agent]	
	[Identification Number]	100109667
	[Patent Attorney]	
30	[Name]	Hiroki NAITOH
	[Indication of Fee]	
	[Registered Number of the Prepayment]	011305
	[Amount of Payment]	21,000 yen
35	[List of Attached Documents]	
	[Article]	Claims 1 copy

[Article]	Specification	1 copy
[Article]	Drawings	1 copy
[Article]	Abstract	1 copy

[General Power

5	of Attorney Number]	9809938
---	---------------------	---------

[Designation of Document] Claims

[Claim 1] An industrial robot comprising a first member and a second member which rotate relatively at a joint portion thereof, wherein a mount portion where a positioning member is embedded and a guide portion along which the positioning member slides so as to protrude are provided in the first member, and wherein an abutment portion which is brought into abutment with the positioning member when the first and second members are made to rotate relatively is provided in the second member.

[Claim 2]An industrial robot comprising a first member and a second member which rotate relatively at a joint portion thereof, wherein a mount portion where a positioning member is embedded and a guide portion along which the first positioning member slides so as to protrude are provided in each of the first member and the second member, whereby the two positioning members are brought into abutment with each other when the first member and the second member are made to rotate relatively.

[Claim 3]The industrial robot as set forth in claim 1 or 2, wherein the positioning member is held at a position where the positioning member does not protrude from the first member when performing a normal operation, whereas only when performing an origin adjustment, the positioning member is made to protrude.

[Claim 4]The industrial robot as set forth in claim 3, wherein the positioning member is brought into abutment at a mechanical origin position of the industrial robot.

[Claim 5]The industrial robot as set forth in claim 3, comprising calculation means for bringing the positioning member into abutment at a position which is displaced from a mechanical origin position through a known angle determined in advance and calculating the mechanical origin position using the known angular displacement and the abutment position of the positioning member.

[Claim 6]The industrial robot as set forth in claim 3, wherein the abutment of the positioning member is determined by monitoring a torque generated in the second member using a current to a driving motor for relatively rotating the second member.

[Designation of Document] Specification

[Title of Invention] Industrial Robot

[Technical Field]

[0001] The present invention relates to an industrial robot.

5 [Background Art]

[0002] As an origin adjustment apparatus for a conventional industrial robot, the following apparatus has existed (refer to Patent Document 1, for example). FIG. 5 shows the conventional origin adjustment apparatus.

10 [0003] In FIG. 5, a first member 11 and a second member 12 are oppositely disposed. A step 13 is formed on a circumferential surface of the first member 11 at an origin corresponding position, and an origin adjustment apparatus is detachably fixed to an origin corresponding position of the second member 12. This origin adjustment apparatus includes a switch means 14 for generating an origin signal, held by a switch holder 15 fixed to the origin corresponding position
15 of the second member 12, and a sliding rod 17 formed in such a manner as to be brought into engagement with an ON/OFF needle of the switch means 14 at one end thereof and adapted to slide by the guide of a linear bearing 16 fixed to the switch holder 15 so as to protrude towards the step 13 formed on the first member 11 at the origin corresponding position at the other end thereof.

20 [0004] In addition, as a second conventional example, the following apparatus has existed (for example, refer to Patent Document 2). FIG. 6 illustrates the conventional origin adjustment apparatus.

[0005] A first member 11 and a second member 12 are provided in such a manner as to rotate relatively, a mount portion 23 is formed on the first member
25 11 for detachably mounting a positioning member 22 thereon, an abutment surface 21 which is brought into contact with the positioning member 22 is provided on the second member 12, and a threaded hole into which a positioning pin can be thread fitted is provided as the positioning member 22.

[Patent Document 1] JP-A-2-180580 (page 14, Figure 5)

30 [Patent Document 2] JP-A-2002-239967 (page 14, Figure 6)

[Disclosure of Invention]

[Problems that the Invention is to Solve]

[0006] In the origin adjustment apparatus illustrated as the conventional example, it is required to prepare the origin adjustment apparatus when the
35 origin adjustment is needed. Further, since the robot apparatus dirties gradually as used in the field, dust-proof needs to be provided for a mount

portion of the origin adjustment apparatus. In addition, as a result of this, the construction becomes complex, and the joint member of the robot as well as the origin adjustment apparatus become expensive.

[0007] Additionally, since a relatively large space is required to set the origin adjustment apparatus, the miniaturization of the joint portion of the robot becomes difficult. In particular, at a wrist shaft of the robot which constitutes an end effector mount portion and the periphery thereof, the accessibility of a distal end portion of the wrist shaft of the robot to a workpiece (an object to be worked on) is disturbed, thus it has a disadvantageous configuration.

[0008] In the origin adjustment apparatus illustrated as another conventional example, while the origin adjustment apparatus is inexpensive, since the positioning member is constructed so as to be thread fitted in the threaded hole and the fixing accuracy of the positioning member depends on to what extent the portion worked on to provide the thread and the portion worked on to provide the pin are coaxial with each other, no high positioning accuracy can be expected.

[0009] In addition, since the positioning accuracy deterioration is generated when the same kind of other one is used, no stable origin adjustment accuracy can be ensured.

[Means for Solving the Problems]

[0010] With a view to solving the problems inherent in the conventional examples, the invention is such that a first member and a second member which rotate relatively are provided at a joint portion of an industrial robot, a mount portion in which a positioning member is embedded and a guide portion along which the positioning member slides in such a manner as to protrude are provided on the first member, and an abutment portion which is brought into abutment with the positioning member which protrudes when the first and second members are made to rotate relatively is provided on the second member. Here, the positioning member and the guide member along which the positioning member slides adopt a socket and spigot construction which is free from mechanical loosening.

[0011] By this construction, an origin adjustment can be realized which is inexpensive and highly accurate and which requires extremely few man hours. Furthermore, since the invention requires no special signal line for origin adjustment due to the construction in which no signal generating device such as a switch is provided, despite the fact that the positioning member is incorporated in the relative rotational member, the invention also has an advantage that no

cable needs to be added and modified within the robot machine.

[Advantage of Invention]

[0012] As mentioned above, an origin adjustment can be realized which is inexpensive and highly accurate and which requires extremely few man hours.

5 [0013] Furthermore, since the invention requires no special signal line for origin adjustment due to the construction in which no signal generating device such as a switch is provided, despite the fact that the positioning member is incorporated in the relative rotational member, the invention also has an advantage that no cable needs to be added and modified within the robot
10 machine. In particular, an origin adjustment which is highly accurate and which requires extremely few man hours can be realized even at the most distal end shaft of the wrist where cable layout is made difficult.

[Best Mode for Carrying Out the Invention]

[0014] Embodiments of the invention will be described below by reference to
15 the drawings.

[0015] (First Embodiment)

FIGS. 1, 2 are drawings showing an origin adjustment apparatus portion of an industrial robot according to a first embodiment. In the drawings, a mount portion 23 in which a positioning member 22 is embedded and a guide
20 portion 24 along which the positioning member 22 slide in such a manner as to protrude are provided on a first member 11, and an abutment portion 21, which is brought into abutment with the positioning member 22 when the first member 11 and a second member 12 are made to rotate relatively, is provided on the second member 12.

25 [0016] Hereinafter, the operation of the industrial robot, which is constructed as described above, will be described. When the industrial robot performs a normal operation, as shown in FIG. 1, the first member 11 and the second member 12 are allowed to perform a free relative rotational operation, and at the same time, the positioning member 22 is embedded in the first member 11 so
30 that a dust proof effect for the positioning member 23 and the guide portion 24 can be exhibited.

[0017] When an origin adjustment is needed, as shown in FIG. 2, the positioning member 22 is made to protrude from the first member 11 along the guide portion 24, and the positioning member 22 and the abutment portion 21
35 are brought into abutment with each other by relatively rotating the first member 11 and the second member 12.

[0018] Here, when determining the abutment between the positioning member 22 and the abutment portion 21, a stable determination can be implemented by monitoring a torque generated from a current to a driving motor for rotating relatively the first member 11 and the second member 12. In addition, the determination may be implemented through the sense and vision of the operator who operates the industrial robot.

[0019] Next, the positioning member 22 and the abutment member 21 are brought into abutment with each other at a mechanical origin position, and the mechanical origin is registered at this position, whereupon the origin adjustment is completed. Note that in the event that the mechanical origin position differs from the abutment position, a difference therebetween is measured in advance before an origin adjustment becomes necessary, and when performing an origin adjustment, a mechanical origin position is calculated from the abutment position and the difference now known, and the mechanical origin position so calculated is then registered as an origin position, whereby the origin adjustment is completed.

[0020] (Second Embodiment)

FIGS. 3, 4 are drawings showing an origin adjustment apparatus portion of an industrial robot according to a second embodiment of the invention. In FIGS. 3, 4, like reference numerals are used as to constituent members like to those described in FIGS. 1 and 2, and the description thereof will be omitted.

[0021] In this embodiment, in place of the abutment portion 21 provided on the second member 12 in the first embodiment, a positioning member 22, which is provided on the first member, and a guide portion 24 along which the positioning member 22 slides in such a manner as to protrude are provided on a second member, whereby an origin adjustment having the same function as that of the first embodiment can be realized by adopting the construction.

[0022] In the first embodiment, the abutment portion 21 is exposed to the outside, and this location needs to be protected against dust in order to perform a highly accurate origin adjustment. In this embodiment, however, the abutment portion 21 is eliminated, and as shown in FIG. 3, the positioning member 22 and the guide portion 24 are embedded when the robot performs a normal operation, and since this provides a complete dust proof construction, a stable origin adjustment can be realized over a long period of time.

[Industrial Applicability]

[0023] Since the industrial robot according to the invention is simple in

construction and can perform a highly accurate origin adjustment, the robot is effective, in particular, when applied to an industrial manufacturing robot for use in production lines.

[Brief Description of Drawings]

5 [0024] [FIG. 1] It is an explanatory drawing which shows an origin adjustment apparatus portion of an industrial robot according to a first embodiment, which is in a normal operation.

[FIG. 2] It is an explanatory drawing which shows the origin adjustment apparatus portion of the industrial robot according to the first embodiment, which
10 is in an origin adjustment operation.

[FIG. 3] It is an explanatory drawing which shows an origin adjustment apparatus portion of an industrial robot according to a second embodiment, which is in a normal operation.

[FIG. 4] It is an explanatory drawing which shows the origin adjustment
15 apparatus portion of the industrial robot according to the second embodiment, which is in an origin adjustment operation.

[FIG. 5] It is a drawing showing an origin adjustment apparatus of a conventional industrial robot.

[FIG. 6] It is a drawing showing an origin adjustment apparatus of
20 another industrial robot.

[Description of Reference Numerals and Signs]

[0025]

- 11 First member
- 12 Second member
- 25 13 Step
- 14 Switch means
- 15 Switch holder
- 16 Linear bearing
- 17 Sliding rod
- 30 21 abutment surface
- 22 positioning member
- 23 positioning member mount portion

[Designation of Document] Abstract

[Summary]

[Problem] In origin adjustment between two members which rotate relatively at a joint of an industrial robot, an origin adjustment apparatus is provided which is inexpensive and highly accurate and which requires extremely few man hours. In addition, an origin adjustment apparatus is provided which is so small in size as to be easily used even on a distal end shaft of a wrist of the robot and which requires no special signal line for origin adjustment.

[Solution] A mount member 23 where a positioning member 22 is embedded and a guide portion 24 along which the positioning member 22 slides in such a manner as to protrude are provided on either one or both of the two members which rotate relatively.

[Selected drawing] Figure 1